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Effect of whole cotton seed supplementation on the carcass and meat qualities of Djallonke sheep raised on-farm in Ghana

G. A. Teye[1], F. Adzitey[1,2], H. K. Dei[1] and A. Kwarteng[1]

[1]University for Development Studies, Animal Science Department, Box 1882, Tamale, Ghana
[1,2]Universiti Sains Malaysia, School of Industry Technology, 11800 Pulau Pinang, Malaysia

Abstract

Twenty Djallonke sheep (ten ewes and ten rams) were evaluated for their carcass and meat quality after being fed with whole cotton seed as a supplement over a period of twelve months on-farm. Supplementation with the whole cotton seed had no adverse effect on carcass quality but significantly ($P<0.001$) improved juiciness. Tenderness, flavour and overall liking were also better in the supplemented group compared to the non-supplemented group. The results suggest that whole cotton seed could be used as a supplementary feed to improve the productivity and meat quality of small ruminants at a cheaper cost in the study area.

Key words: Carcass quality, Djallonke Sheep, Meat Quality, Non-supplementation Supplementation

Introduction

Cotton seed is a by-product obtained from the ginning of cotton, and can be used to cut down cost of using commercial concentrates in small ruminant production. Charray et al. (1992) showed that cotton seed as feedstuff has relatively high content of protein (18-25%), fat (10-23%) and cellulose (25-30%); which can safely be integrated into ruminant's diets at a level of 0.25% of dry matter feed (Arieli, 1992).

Sheep production plays an integral role in the livelihood of rural communities especially in the Northern region of Ghana. They are kept mainly as a source of income, meat, skin, and a risk reduction strategy in the farming system to ensure food security. Majority of farmers in Ghana also consider small ruminant production as cash income to fall on when the need arises (Ntifo-Siaw and Ghartey, 1988; FASDEP, 2002) and provides employment opportunities for most of the unemployed and underemployed in rural areas.

Despite the significant roles sheep play in the livelihood of majority of farmers in Ghana, feeding of small ruminants in the dry season is very difficult due to scarcity of or the poor quality of feed resources. As a result, productivity of animals decreases as the animals' lose weight considerably (Esther, 2005). Feeding on fodder trees, legumes and shrubs have the potential of alleviating some of the problems of feed shortages and nutritional deficiencies experienced in the dry season on small holder farms. Concentrate supplementation reduces age to slaughter, increases carcass quality and increase meat output thereby improving access to animal protein and income to households in the traditional sector in Tanzania (Mtenga and Kitalyi, 1990). This suggests that finishing sheep by supplementing their diets with readily available and cheap feed resources such as whole cotton seed have positive impact on the animal and meat quality thereby contributing to improving household income and food security. Karbo and Bruce (2000) reported that 22,200,000-24,220,000 kg of cotton seeds are produced annually in Northern Ghana hence, cotton seeds could be utilized as a readily available feed supplement for small ruminants in the dry season. Studies have showed that feeding sheep on-station on whole cotton seed had no adverse effect on meat and carcass quality. The present study aimed to provide information on the effects of feeding sheep on whole cotton seed-on farm as a supplement on meat and carcass quality characteristics.

Materials and Methods

The experiment was conducted on-farm in three districts (Savelugu, Tolon and Tamale) all in the Northern region of Ghana over a twelve (12) month period.

On-farm animals used in this study were owned by the farmers. The supplemented group were confined and fed with cotton seeds daily in the morning before

being released to join the other flock for grazing. The mean quantity of whole cotton seed fed per day to each animal on supplemented diet was 0.34 kg.

After twelve months of feeding, a total of twenty sheep of the same age from supplemented and non supplemented group were randomly selected for slaughtering at the University for Development Studies Meat Processing Laboratory. The final live weights of the selected animals were recorded before slaughtering. The animals were bled by severing the carotid arteries in the jugular furrow close to the head. Singeing was done by the use of fire and a knife to scrape off the hair on the skin.

Carcass weights (immediately after slaughter and chilling overnight), primal cuts (head, neck and legs), muscles (fillet and *longissimus dorsi*), visceral (filled and empty rumen), and fat around the recticulo-rumen (omental), intestines (mesenteric) were taken using a digital scale. Carcass lengths (from the pelvic bone to the anterior edge of the first rip) were measured using tape measure.

Eating quality of the *longissimus dorsi* was assessed by a taste panel consisting of ten assesors for tenderness, juiciness, colour and flavour. Assessors used category scales one to eight (1-8) to evaluate tenderness (1-extremely tough, 8-extremely tender), juiciness; (1-extremely dry, 8-extremely juicy), chevon and mutton flavour; (1-extremely weak, 8-extremely strong), abnormal flavour; (1-extremely weak, 8-extremely strong) and overall liking; (1-dislike very much, 8-like very much).

Statistical analysis

Statistical analysis was performed using Minitab version 15.0 (Minitab, PA, and USA). All data were analysed using a general linear model of analysis of variance (ANOVA) using diets as factor.

Results and Discussion

This study was set up to find out whether supplementing sheep on-farm with whole cotton seed will have any effect on carcass and meat quality compared to their counterparts without supplementation. The sheep (belonging to the farmers) on supplementation were fed with an average of 0.34 kg per day per animal in the morning before being allowed to graze during the day with the control (non supplemented group). Thus supplementation was done alongside with the normal procedure the farmers adapt in feeding their sheep and other husbandry.

Table 1 shows the effects of supplementation on carcass length, live, warm carcass, cold carcass and bleed weights.

Supplementation did not have a significant effect ($P>0.05$) on the live weight, carcass length, bled weight, and warm and cold carcass weights measured though the carcass values for the supplemented group were relatively smaller than the control. The carcasses of the control group were relatively heavier and correspondly longer. The anti-nutritional factor present in cotton (gossypol) which often exerts their effects on the digestive tract might have cause anorexia during grazing in the supplemented group and consequently reduced feed intake and weight. Though the control sheep were relatively bigger and longer the difference in carcass characteristics were not significant ($P>0.05$). This shows that feeding of sheep on 0.34kg of whole cotton seed a day have no adverse effect on growth performance, warm and cold carcass weights.

Warren et al. (1988) assessed the effects of whole wheat grain to whole cotton seed (WCS) at ratios of 100:0 (diet A), 75:25 (B) and 50:50 (C) and reported that live weight changes for diets A, B and C were -0.3, +4.4 and +3.0 kg respectively, and were significantly ($P<0.05$) greater on WCS diets. They also reported that although WCS reduced digestibility and subclinical effects on health, at least 25% WCS can be safely included in a wheat-based maintenance ration for wethers and this ration has production advantages over wheat alone.

From Table 2, *Longissimus dorsi*, mesenteric fat, and fillet did not differ significantly ($P>0.05$) from each other between the treatments. There was marginal increase in mesenteric fat for supplemented group than the control whilst the mean weights of *Longissimus dorsi* and fillet were relatively smaller in the supplemented than the control group. The relatively higher carcass weights found in the control sheep was not reflected in the *longissimus dorsi* and fillets weights which are highly priced muscles. Instead both the control and supplemented groups have similar weights for *longissimus dorsi* and fillets. This indicates that the supplemented group were able to produce similar weights and during the dry season when feed is scarce sheep could be fed on whole cotton seed.

Primal cuts showed insignificant difference ($P>0.05$) between the two treatments. However, the weights of the control group were relatively higher than the supplemented. The relatively higher live and carcass weights found in the control sheep was not reflected in the weights of primal cuts. Instead, both the control and supplemented groups had similar weight for primal cuts indicating that, the supplemented group were able to produce similar cuts thus the cotton seed which might contain anti-nutritional factor did not adversely affect the primal cuts. Mtenga and Kitalyi (1990) stated that supplementation reduces age to slaughter, increase carcass quality and output and thereby improves access to animal protein and income.

There were no significant differences ($P>0.05$) between the viscera weights for sheep, although

Table 1: Live weights, carcass length, bled weight, warm and cold and carcass weights of sheep

Parameters	Diets		SEM	P-Value
	Supplemented	Control		
Live weight (kg)	14.83	16.16	3.28	0.43
Warm carcass weight (kg)	6.41	7.02	1.66	0.48
Cold carcass weight (kg)	6.34	6.94	1.66	0.48
Bled weight (kg)	13.85	15.35	3.18	0.36
Carcass length (cm)	46.45	49.50	3.80	0.13

SEM: Standard error of means, P: Probability

Table 2: *Longissimus Dorsi*, fillet, and mesenteric fat content of sheep

Parameters	Diets		SEM	P-Value
	Supplemented	Control		
Fillet (g)	72.80	73.20	18.58	0.97
Mesenteric fat (g)	0.48	0.47	0.04	0.84
Longissimus dorsi (g)	330.00	350.00	0.10	0.75

SEM: Standard error of means, P: Probability

Table 3: Weight's of primal cuts of sheep

Parameters	Diets		SEM	P-Value
	Supplemented	Control		
Neck (kg)	0.59	0.61	0.12	0.74
Belly (kg)	2.56	2.87	0.62	0.33
Legs (kg)	0.30	0.33	0.06	0.35
Head (kg)	1.03	1.10	0.22	0.51
Hind quarters (kg)	2.71	3.08	0.70	0.31
Fore quarters (kg)	3.05	3.26	0.84	0.62

SEM: Standard error of means, P: Probability

Table 4: Visceral weight of sheep

Parameters	Diets		SEM	P-Value
	Supplemented	Control		
Kidney (g)	78.80	90.00	21.80	0.32
Lungs (g)	317.20	355.60	89.66	0.40
Spleen (g)	52.60	59.80	18.76	0.45
Heart (g)	85.20	102.40	27.06	0.22
Liver (g)	332.80	345.80	87.94	0.77
Empty rumen (g)	0.51	0.64	0.16	0.11
Full Intestines (g)	1.16	1.30	0.34	0.40
Empty intestines (g)	0.72	0.76	0.24	0.72
Full viscera (g)	4.70	5.24	1.10	0.35

SEM: Standard error of means, P: Probability

Table 5: Eating qualities of sheep *Longissimus dorsi* muscle

Attributes	Diets		SEM	P-Value
	Supplemented	Control		
Flavour	4.00	3.70	0.34	0.12
Juiciness	5.10^a	4.20^b	0.46	0.00
Tenderness	4.70	4.40	0.48	0.27
Overall liking	5.20	5.00	0.46	0.32

SEM: Standard error of means, P: Probability

visceral values for the control were relatively higher than the supplemented group (Table 4). This could be a reflection of their similar carcass and primal cuts weight thus cotton seed had no negative effect on the development of the visceral components.

Supplementation significantly improved juiciness ($P<0.001$); the other attributes, flavour, tenderness, and overall liking were also better in the supplemented group than the control group as shown in Table 5. The significant juiciness in the chevon is a positive effect of whole cotton seed on eating quality. The juiciness could be attributed to a higher water binding capacity induced by the cotton seed. The improved juiciness had positive effect on t attributes such as tenderness and flavour which were relatively better in the supplemented group.

Conclusion

Most animal experiments are carried out on-station; some of which are difficult or impossible to practise on-farm. This work addresses that by experimenting animals practically on-farm which can easily be adapted by farmer as part of their normal farming practises. In addition, there is scarcity of feed during the dry season especially in the three Northern regions of Ghana and most animals suffer from weight loss which subsequently affects farmer's profit when the they sell their animals during that season. This work provides information on the usefulness of whole cotton seed which is readily available to farmers in the study area to maintain weight of their small ruminants during the dry season where weight losses in most animals are apparent in the Northern regions of Ghana. The utilization of whole cotton seed has no adverse effect on the carcass quality. In addition, the eating qualities were positively affected by supplementation. Therefore whole cotton seed can be used as supplementary feed for ruminants during the dry season when fodder is scarce to improve upon the performance of their animals.

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